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BUREAU OF STANDARDS

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STANDARD SPECIFICATIONS FOR COTTON RUBBER-
LINED FIRE HOSE

PREPARED BY THE BUREAU OF STANDARDS IN COOPERATION WITH TECHNICAL REPRESENTATIVES OF LEADING MANUFACTURERS OF FIRE HOSE, AND SUBMITTED TO AND OFFICIALLY INDORSED BY THE RUBBER ASSOCIATION OF AMERICA

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I. INTRODUCTION

This specification is to cover the purchase of hose for fire-protection purposes, and in placing orders the following points should be borne in mind:

Single-jacketed hose is for use at fire hydrants, standpipes, and similar places. It will not withstand frequent service and is not suitable where the fabric will be subjected in service to chafing on rough or sharp surfaces.

Double and triple jacketed hose is for use on pumping engines and in places where service conditions require the additional protection against wear afforded by the extra cotton jackets.

II. STANDARD SPECIFICATIONS

The hose shall be made of a rubber lining, a rubber backing, and a single, double, or triple cotton jacket as specified. Each length shall be furnished with couplings attached.

All materials shall be of good quality for the purpose, and without characteristics which would prove harmful to the life or functioning of the hose.

A. RUBBER LINING**1. MATERIAL**

(a) **RUBBER CONTENT.**—The rubber lining shall be made from and have the characteristics of a properly cured compound containing at least 75 per cent by volume of the best quality new wild or plantation rubber. (The specific gravity of crude rubber is taken as 0.94.) It shall be free from ingredients known to the trade as oil substitutes and reclaimed rubber.

(b) **ORGANIC ACETONE EXTRACT.**—The organic acetone extract shall not exceed 5 per cent of the weight of rubber as compounded.

(c) **TOTAL SULPHUR.**—The total sulphur content shall not exceed 8 per cent of the weight of rubber as compounded. Sulphur in barytes shall not be included in the allowable sulphur content.

2. FORM

The rubber lining shall be made from calendered sheets, not less than three plies vulcanized into one solid body.

The lap joint shall be as small as consistent with good manufacturing practice.

The lining shall be smooth and practically free from corrugations, pitting, and other imperfections.

3. THICKNESS

The rubber lining shall be of a uniform thickness within the limits shown in Table 1.

TABLE 1.—Thickness of Rubber Lining Exclusive of Backing

Size of hose	Maximum	Minimum
	Inch	Inch
2.5 inches	0.072	0.058
3 inches	.072	.058
3.5 inches	.095	.072

4. TENSILE STRENGTH¹

Minimum, 1600 lbs./in.², tested across the fold.

5. ULTIMATE ELONGATION¹

Minimum, 500 per cent (2 to 12 inches).

6. SET¹

Maximum, 25 per cent after a stretch of 400 per cent (2 to 10 inches) for 10 minutes with 10 minutes rest.

¹ Test pieces shall be 0.5 inch wide, cut transversely across the fold. It is necessary to buff the test pieces carefully in order to determine the tensile strength accurately.

7. STRENGTH OF LAP

Minimum, 75 pounds per (linear) inch.

8. FRICTION

The adhesion between backing and jacket, and between backing and lining, shall be such that a weight of 12 pounds suspended from a strip 1.5 inches wide will cause separation at a rate not greater than 1 inch per minute.

9. LIFE TEST OF LINING

The tensile strength of the lining as determined with test pieces 0.5 inch wide prepared from strips (cut transversely across the fold) which have been subjected to the action of dry heat at $158 \pm 2^\circ \text{F}$ for 196 hours shall be not less than 900 lbs./in.²

B. RUBBER BACKING**1. FORM**

The backing shall be made from calendered sheet.

2. THICKNESS

The backing shall be of a uniform thickness which, measured from the bottom of the impressions left by the jacket, shall be not greater than 0.028 inch.

C. THE COTTON JACKET**1. MATERIAL**

The jacket shall be well, evenly, and firmly made from good cotton, as free from unsightly defects, dirt, knots, lumps, and irregularities of twist as is consistent with good manufacturing practice.

2. CONSTRUCTION

The jackets shall be seamless and have the fillers woven around the hose throughout its length and the warps interwoven with and covering the fillers. The jackets may be separate or interwoven.

D. COUPLINGS**1. MATERIAL**

The couplings shall be made of an alloy of copper, tin, zinc, and lead, each within the proportion limits indicated in Table 2.

TABLE 2.—Composition of Couplings

Metal	Minimum	Maximum
	Per cent	Per cent
Copper.....	82	
Tin.....	7	
Zinc.....		7
Lead.....		3

The metal shall be free from porosity and injurious defects.

2. FORM

The couplings shall be of the expansion-ring type and shall conform to the national standard for fire-hose couplings, as recommended by the National Fire Protection Association (see also Bureau of Standards Circular No. 50), unless otherwise specified, in which case full details and gages shall be furnished by the purchaser. They shall be finished in a workmanlike manner throughout. The edges of the expansion rings shall be smooth and well rounded.

3. MEASUREMENTS

The couplings shall be machined accurately to the dimensions and weight specified.

4. ATTACHMENT OF COUPLINGS

The couplings shall be attached to the hose in a workmanlike manner without injury to the lining or to the jacket.

5. GASKETS

Each set of couplings shall be provided with three rubber gaskets of a composition which meets the chemical requirements for hose lining. One gasket shall fit accurately the swivel of the coupling, and one (not less than one-eighth inch thick) shall be placed under the end of each expansion ring. When the coupling is made up snugly, as in service, the gasket in the swivel shall not be compressed to such an extent as to project beyond the inside surface of the coupling.

E. FINISHED HOSE

1. DIAMETER

The internal diameter of hose shall be not less than that indicated by the trade size. There shall be no contraction of diameter when the hose is under pressure. If the hose is noticeably elliptical under pressure, its maximum and minimum diameters shall be measured. The variation in diameter shall not exceed one-eighth inch.

2. LENGTH

Unless otherwise specified the hose shall be furnished in lengths averaging not less than 50 feet. No length before sampling shall be less than 48 feet.

3. WEIGHT

The weight of hose without couplings shall be in accordance with the requirements of Table 3.

TABLE 3.—Weight of 50 Feet of Hose Without Couplings

Number of jackets, separate or interwoven	Size of hose Inches	Weight	
		Maximum	Minimum
1.....	2.5	43	35
2.....	2.5	60	
	3	80	
	3.5	110	
3.....	2.5	75	
	3	100	
	3.5	135	

4. ELONGATION

The elongation measured from back to back of couplings shall be in accordance with the requirements of Table 5. There shall be no contraction or shortening of hose under pressure.

5. EXPANSION

The expansion or increase in circumference shall be in accordance with the requirements of Table 5.

6. TWIST

The twist shall be in accordance with the requirements of Table 5.

7. WARP

The warp shall be in accordance with the requirements of Table 5.

8. RISE

The hose shall not rise from the surface on which it rests a greater distance than that stated in Table 5.

9. EFFECT OF KINKING

See Table 5.

10. FLEXIBILITY

The hose must be flexible and easily coiled.

11. MARKING

Each length of hose passing the requirements shall be indelibly stenciled at the ends in letters 1 inch high with the manufacturer's name, the month and year of manufacture, and the words "Tested to — lbs. per sq. in." (the test pressure specified in Table 5). The lettering shall begin approximately 4 feet from the couplings.

III. TECHNICAL TESTS**A. HYDRAULIC TEST AT FACTORY**

Each length of hose with couplings attached shall be subjected by the manufacturer to a hydraulic pressure test for elongation, twist, warp, and rise.

One length of hose in every 10 shall be subjected to a kinking test and shall withstand the pressure indicated in Table 5 without any indication of weakness.

The above tests shall be conducted as described under III C-2 except that the maximum pressure shall be maintained only long enough for purposes of inspection.

Each length of hose after test shall be carefully drained and the cotton jacket thoroughly dried before shipment.

B. SAMPLING

One length of hose from each 50 lengths or fraction thereof shall be selected by the inspector or other authorized representative of the purchaser, for performing the tests for acceptance. A piece shall be cut from this hose and a coupling attached by the manufacturer to the cut end, the length being such as to measure 3 feet between the backs of the couplings. The manufacturer shall also attach a coupling to the cut end of the longer piece, which, if the hose is accepted, shall be paid for as a full 50-foot length.

The couplings on the 3-foot length shall remain the property of the manufacturer.

These two pieces of hose shall be subjected to hydraulic tests by the purchaser, in accordance with the procedure described under III-C, after which the couplings shall be removed from the 3-foot sample and examined for compliance with the specification. The 3-foot length of hose shall then be used in the preparation of samples for physical and chemical laboratory tests.

C. HYDRAULIC TESTS BY PURCHASER**1. DETAILS OF 3-FOOT SAMPLE**

The 3-foot sample shall show no sign of weakness when subjected to hydraulic pressure increasing gradually at the approximate rate of 300 pounds per minute as shown in Table 4. The test shall be made first with the hose lying straight, and second with the hose held to a circular arc of 27-inch radius. The coupling remote from the source of water shall be closed with a cap or plug provided with a pet cock to permit the escape of air while the hose is being filled with water.

TABLE 4.—Hydraulic Test Pressures to be Applied to 3-foot Sample

Kind of hose (No. of jacket)	Test pressure
	Lbs./in. ²
Single.....	500
Double.....	600
Triple.....	600

2. DETAILS OF 47-FOOT SAMPLE

The hose shall be laid out straight on a smooth surface such as a cement walk. One coupling is connected to the source of water supply, the other coupling being closed with a cap or plug provided with a pet cock for the escape of air while the hose is being filled with water. To insure the complete removal of air from the hose, the surface on which the hose rests should be slightly inclined toward the source of water supply.

With a crayon or soft pencil make three marks around the hose jacket, dividing its length approximately into four equal parts. The circumference of the hose shall be measured at these marks during the test, as described later.

With the pet cock open, admit water into the hose gradually until the air has been expelled and the hose is completely filled with water. The pet cock shall then be closed and the pressure gradually increased until the gage (which shall have been tested for accuracy) shows a pressure of 10 lbs./in.², when the water supply shall be cut off and a mark made on the top surface of the hose jacket adjacent to the closed coupling. This mark is used as a means of measuring the amount of twist during the test.

With a steel tape measure the length of hose between backs of couplings, recording the result to the nearest one-quarter inch and with a small flexible steel tape measure the circumference

of the hose at the three equidistant points above referred to, and record the results to the nearest one-thirty-second inch.

Water shall now be gradually admitted into the hose in such quantity as will increase the pressure per square inch at an approximate rate of 300 pounds per minute, and while the pressure is being increased the hose shall be carefully examined for leakage or other defects. When the test gage indicates the pressure specified in Table 5 for the kind of hose being tested, the source of water supply shall be shut off and the hose shall be allowed to remain under this pressure for 10 minutes. When 8 minutes have elapsed, the following measurements shall be taken and recorded: (a) the length of hose between the backs of couplings, following the contour of the hose; (b) the circumference of hose at the three equidistant points; (c) the amount of twist as indicated by the mark on the hose jacket adjacent to the closed coupling measured to the nearest one-eighth turn; (d) the amount of "warp" or deviation from a straight line as measured from a cord stretched from center to center of the backs of couplings, and (e) the rise from the surface on which the hose rests.

Two pressure gages should be provided for this test, one graduated from 0 to about 20 lbs./in.², the other from 0 to about 1000 lbs./in.². The low pressure gage is used only to indicate the pressure of 10 lbs./in.², at which the initial measurements are taken. It should be provided with a shut-off valve and relief cock to protect it against the higher pressures used in the test.

TABLE 5.—Requirements for Hydraulic Test Applied to Full Length.

Nature of data	Numerical requirements for—		
	Single jacket	Double jacket	Triple jacket
Test pressure for initial measurements, pounds per square inch.....	10	10	10
Test pressure for elongation, expansion, twist, warp, and rise, pounds per square inch.....	300	400	400
Test pressure for kinking, pounds per square inch.....	250	300	300
Elongation, maximum per cent.....	10	7	6
Expansion, maximum per cent.....	3	3	3
Twist ^a to right, maximum degrees per foot.....	25	10	10
Twist ^a to left, maximum degrees per foot.....	0	0	0
Warp ^b maximum inches.....	20	20	20
Rise, maximum inches.....	4	0	0

^a A twist to the right (the direction that would tend to tighten the couplings) is indicated by a clockwise rotation of the coupling, looking from the hose toward the coupling. A twist to the left is indicated by a counter-clockwise rotation. A maximum twist to the left of 2° per foot will be permitted while pressure is being raised but any final twist must be to the left.

^b Deviation from a straight line.

The pressure shall then be released and the hose doubled back on itself and tied so as to form a sharp kink at a point about 18 inches from the coupling remote from the pump. The pressure shall then be raised to the amount indicated in Table 5 and released after 5 seconds.

The hose while undergoing the above hydraulic tests shall not leak, sweat, nor show any indication of weakness. There shall be no leakage at the couplings nor breaking of threads in the jacket.

Failure of either the 3 or the 47 foot length of hose to meet all the requirements specified for the hydraulic tests shall be cause for rejection of the 50 lengths of hose represented by these test pieces. If all the requirements of the hydraulic test are met, physical and chemical laboratory tests shall be made.

D. PHYSICAL AND CHEMICAL TEST METHODS

All physical tests and chemical analyses shall be conducted in accordance with this Bureau's methods.

IV. BASIS OF PAYMENT

Hose shall be paid for on the basis of 50 feet to the length. In no case shall the length be less than 48 feet and the average length shall be not less than 50 feet. Measurements shall be made from back to back of couplings with the hose rolled out straight and under a pressure of 10 lbs./in.²

V. INTERPRETATION OF SPECIFICATIONS

Units, standards, and methods of measurement, unless otherwise prearranged, shall be in accordance with those accepted or recognized by this Bureau.

In case of dispute, this Bureau may be appealed to for a decision on such points as may not be agreed upon by the parties concerned.

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